(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 0 791 746 A1

(12) **EUROPEAN PATENT APPLICATION**
published in accordance with Art. 158(3) EPC

(43) Date of publication:
27.08.1997 Bulletin 1997/35

(21) Application number: **95935325.1**

(22) Date of filing: **25.10.1995**

(51) Int. Cl.[6]: **F02M 27/04**

(86) International application number:
PCT/CN95/00082

(87) International publication number:
WO 96/12885 (02.05.1996 Gazette 1996/20)

(84) Designated Contracting States:
AT BE CH DE DK ES FR GB GR IE IT LI LU NL PT SE

(30) Priority: **25.10.1994 CN 94113646**

(71) Applicant: **Wang, Wenhao**
Chaoyang District, Beijing 100028 (CN)

(72) Inventor: **Wang, Wenhao**
Chaoyang District, Beijing 100028 (CN)

(74) Representative: **Guerre, Dominique et al**
Cabinet Germain et Maureau,
12, rue Boileau,
BP 6153
69466 Lyon Cedex 06 (FR)

(54) FUEL-SAVING APPARATUS

(57) A magnetic fuel-saving apparatus for an internal combustion engine includes a magnetic chamber. In said chamber, there are pairs of arranged permanent magnets. The poles of said pairs of arranged magnets face each other and form a gap of 0.5-2.0mm to pass said fuel. A magnetic filter chamber including a permanent magnet is arranged parallel to said magnetic chamber. A magnetic plate is arranged in each opposite end of facing magnets to form a closed circuit. A magnetic plate is arranged in one end of said magnet in said magnetic filter chamber, and another magnetic plate is arranged in the opposite position of said plate on bottom of said magnetic filter chamber to form a regular gap between said permanent magnet and said plate, and provides a closed circuit between said permanent magnet and said plate. The magnetic fuel-saving apparatus can be made up of multichambers and multi-passages.

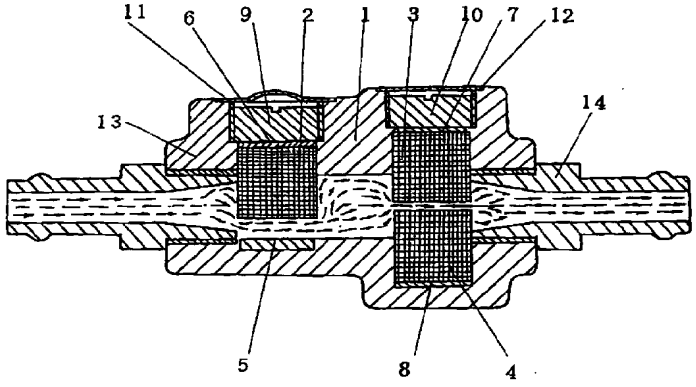

FIG. 2

EP 0 791 746 A1

Description

The invetnion relates to an internal—combussion engine, more particularly, to a magnetization fuel—economizing device for automobile fuel engine.

In order to reduce the fuel consumption to improve combustion, there existed a method for fuel magnetization. This method causes the fuel to flow through a magnetization device for fuel so as to improve the dispersed property and atomization level of the fuel which will bring about the fuel to combust sufficiently, thus to realize the aim of fuel saving.

the utility model No. ZL9220 6719.8 disclosed a double—cavity magnetization fuel—economizer shown as Fig. 1, which has a through cavity along the longitudinal direction of the aluminium alloy housing of the fuel—economizer and the through cavity has its two ends to join with respectively threaded connection, tube connectors, there arranges in the housing a magnetization cavity connected veritcally with the longitudinal through cavity with two cylindrical permanent magnets in the magnetization cavity; in addition, there is a magnetic filter cavity with a cylindrical permanent magnet in it. After the two permanent magnets loaded in the magnetization cavity with their N poles opposed each other, the upper end of magnetization cavity is sealed with a cylindrical block, the advantage of this utility model is that the permanent magnets have a higher magnetic energy product and a higher inherent coercitive force, which will cause fuel to combust, sufficiently and to increase the output power of the engine through forming a stronger magnetizaiton effect without having to be superimposed by a static electrical field. Meanwhile, the contents of carbon monoxide and hydrocarbons reduce, and the iron magnetic materials in the fuel will be less accumulated in the magnetic filter cavity by means of the adsorption of the magnet in this cavity.

However, in this utility model, the arrangement of these permanent magnets can not form a closed magnetic circuit, which will influence the intensity of magnetic field. Therefore, there exists still a need to further increase the intensity of magnetic field so as to improve the magnetization for the fuel.

An object of the invention is to provide a new structure of the magnetization fuel—economizer to improve the above mentioned structure, which can form a closed magnetic circuit in the fuel—economizer, thus to increase the magnetic field intensity and to further improve the magnetization effect of the fuel with the results that a high combustion efficiency of the fuel can be obtained hence the output power of the engine may be enhanced to realize a fuel saving and a exhaust gas clean—up. Meanwhile, the magnetic field intensity of the magnetic filter cavity can be increased enough such that the iron magnetic materials suspended in the fuel can be totally adsorbed on this cavity and do not jam up the cavity again.

The invention provides a magnetiziton fuel—economizer for an internal combustion engine, which includes a housing having a longitudinal through cavity with its two ends having respectively been disposed hermetically on each of them, a tube connector communicated with a fuel supply pipe, the tube connector possessing a flared flow passage, a magnetization cavity being perpendicular to the through cavity and having been disposed in it two permanent magnets with their magnetic poles opposed each other and the interval between the two permanent magnets forming a fuel passing gap with a width of 0.5~2.0mm; in addition, which includes also a magnetic filter cavity arranged to communicate with the through cavity and to parallel to the magnetization cavity with a permanent magnet in the magnetic filter cavity, characterizes in that the other ends of the opposed magnetic poles of the two permanent magnets in the magnetization cavity are provided respective, with magnetic circuit sheets to form a closed magnetic circuit, and that one end of the permanent magnet in the magnetic filter cavity is provided with a magnetic circuit sheet and the other end of the permanent magnet is opposed to a magnet circuit sheet disposed on the bottom surface of the magnetic filter cavity, thus to form a closed magnetic circuit and to form a fixed fuel passing gap between the permanent magnet and the just said magnetic circuit sheet.

In comparison with the prior art, since the application of the fuel—economizer of the structure having magnetic circuit sheets according to the invention, it is possible to form a closed magnetic circuit in the fuel—economizer, also to enhance the instrumental magnetic field intensity and the magnetization efficiency of fuel, thus to realize the aim of fuel saving and exhaust gas clean—up

Fig. 1 is a sectional view of a magnetizaiton fuel—economizer according to the prior art;

Fig. 2 is a sectional view of the magnetization fuel—economizer according to a first embodiment of the invention;

Fig. 3 is a vertical view of the magnetization fuel—economizer according to the invention;

Fig. 4 is a sectional view of the magnetization fuel—economizer according to a second embodiment of the invention; and

Fig. 5 is a sectional view of the magnetization fuel—economizer according to a third embodiment of the invention.

The invention will be described in the following through its embodiments with reference to the accompanging drawings, in which the some part is denoted by the same reference numeral.

As shown in fig. 2, a housing is denoted by the reference numeral 1, which is made of aluminium alloy. The housing 1 has a longitudinal and circular through

cavity, and the inner walls of the two ends of the cavity are formed with inner threads, the housing 1 is formed on it a magnetic filter cavity and a magnetization cavity, and the two cavities are all perpendicular to and communicated with the longitudinal cavity. The two ends of the through cavity are joined hermetically with tube connector 13 and 14 respectively. The tube connectors are made of aluminium alloy or brass. The inner flow passage of the tube connecters is shaped as one end to be a flare expanded outwordly and to connect with the fuel—economizer, and the other portion of the tube connector formed as a straight tube communicated with a fuel supply pipe, a carburetor or a fuel injection pump.

The magnetization cavity is a circular hole with two permanent magnets 3 and 4 disposed in it with their magnetic poles opposed each other. A fuel passing gap with a width of 0.5~2.0mm is formed between permanent magnets 3 and 4, which may oppose each other with the N pole to N pole, or S pole to S pole, or N pole to S pole, and have the magnetic circuit sheets 7 and 8 disposed on the other ends of the apposed magnetic poles of the magnets 3 and 4 respectively, so that a closed megnetic circuit is formed.

The magnetic filter cavity is a stepped hole communicated with the longitudinal through cavity of the housing 1 and the surface of the housing 1. A permanent magnet 2 is mounted in the magnetic filter cavity with one end of the magnet provided with a magnetic circuit wheet 6 and the other end of the magnet opposed to a magnetic circuit sheet 5 disposed on the undersurface of the magnetic filter cavity, thus to form a closed magnetic circuit. A fixed fuel passing gap is formed between the permanent magnet 2 and the magnetic circuit sheet 5. In this embodiment, the width of the gap is about 1~5mm, and preferably, 2~3mm. the magnetic circuit sheet 5 is mounted in a recess of the housing on the bottom of the magnetic filter cavity which may be realized through a shrink fit and a compression bonding of a industrial gelatin.

Since the magnetic circuit sheets of the aforesaid type are applied in the magnetization cavity and the magnetic filter cavity, the closed circuits of high intensity magnetic field are formed, which will enhance greatly the magnetization effect of the fuel in the fuel circuit and achieve a notable effect of fuel saving and exhaust gas clean—up.

In this embodiment, the permanent magnets 2, 3 and 4 are made as cylindrical bodies from a material of NF30 with diameters and heights all in the range from 6mm to 80mm. The inherent coercive force of the permanent magnet is in the range of 18000~20000 oersteds. After magnetizing by means of a conventional art, the magnetic field intensity of the N—pole face is in the range from 4000 to 5200 gausses.

In this embodiment, magnetic circuit sheets 5, 6, 7, and 8 are in shapes of circular disk or cylinder with diameters from 6 to 80mm and thicknesses from 0. 3 to 10mm, and all can be made from magnet conductance material such as iron DT4 of the industrial purity level or silicon steel sheet.

During the operation of a fuel engine, the fuel passes through the fuel supply pipe into the double cavity magnetization fuel—economizer, when the fuel flows through the fuel passing gap formed between the permanent magnet 2 and the magnetic circuit sheet 5 on the bottom of the magnetic filter cavity, the area passed by the fuel flow changes abruptly, and the flow rate of fuel changes suddenly from slowness to fastness, thus the fuel flow forms substantially as a tarbulence. The molecular group structures of the fuel under the turbulent state are in collision and friction with each other, and turns from a relative stable state to a metastable state under the influence of molecular Brownian movement, under the action of premagnetization of the closed megnetic circuit formed by the permanent magnet 2 in the magnet filter cavity with magnetic circuit sheets 5 and 6, the molecular groups under metastable state are broken up partially, the fuel particulates tend to be finer and dispersed, meanwhile and the iron magnet particles suspended in the fuel are adsorbed totally on the permanent magnet 2, which purify the fuel. The fuel flowed out from the above mentioned fuel passing gap moves through the longitudinal through cavity of the housing into the fuel passing gap formed between the permanent magnet 3 and 4 of which their magnet poles are opposed each other. Now, the area passed by fuel flow in this gap changes from small to big, and again suddenly becomes very small, and the fuel which has been in a high speed turbulent state is again influenced intensively by a high density magnetic force line in the closed magnetic circuit formed by permanent magnets 3 and 4 as well as magnetic circuit sheets 7 and 8, thus the molecular groups of metastable state are further broken up massively, the visicosity and density of the fuel are reduced, the fuel particulates become smaller and easier to be dispersed, the level of fuel atomization is enhanced and the condition for fuel to combine with oxygen has been improved remarkably, so that the fuel can be combusted more sufficiently, therefore the output power of engine can be increased and the exhaust gas is clean—up.

During assembly, the magnetic circuit sheets 7 and 8 are first attached respectively on the other ends of the opposed poles of permanent magnets 3 and 4, then the permanent magnets 3 and 4 are disposed in the magnetization cavity, a round block 10 is fixed on the magnetization cavity and sealed through on adhesive to prevent from leakage. The fuel passing gap between permanent magnets 3 and 4 should have a width in the range of 5~2.0mm. Mounting on tube connectors 13 and 14, then the magnetic circuit sheet 5 is compression bonded through a shrink fit in the recess on the bottom of the magnetic filter cavity. The diameter of magnetic circuit sheet 5 should be less about 1mm than that of the permanent magnet.

2. Then, the permanent magnet 2 is inserted into the magnetic filter cavity, so that a pole opposes to the magnetic circuit sheet 5, and a step restricts the magnet

2 in a certain position such that the fuel passing gap between magnetic circuit sheet 5 and the magnetic pole is of a width preferably in the range of 2~3mm. Finally, screwing down a cavity cover 9 to seal and to bond the cover.

When the magnetization fuel—economizer according to the invention will be mounted on an engine, the connection position are some what different due to the kind of engines. When it is mounted on a gasoline engine, the fuel inlet is connected with a fuel supply pipe of a gasoline pump, and the fuel outlet is connected with a carburetor and is preferable to be mounted directly on the carburetor. When it is mounted on a diesel engine, the fuel inlet is connected with the fuel outlet tube of of the filter, and the fuel outlet is connected with the fuel injection pump and is preferable to be mounted directly on the fuel inlet of the fuel injection pump.

Fig. 4 and 5 show respectively the second and third embodiments according to the invention. They are multi—fuel circuit fuel—economizer respectively, and are suitable for large internal engines of large tonnages automobiles, tractors, locomotives and ships.

Fig. 4 shows a multi—cavity magnetization fuel—economizer, which has been in its longitudinal through cavity disposed three or more magnetization cavities arranged vertically, and parallelly each other, in these cavities there are many pairs of permanent magnets with magnetic circuit sheets. The arrangements of permanent magnets and magnetic circuit sheets are the same as in embodiment 1. To dispose many pairs of permanent magnets is used for repeatedly magnetizing the fuel to increase the magnetization effect.

Fig. 5 shows a multi—fuel circuit magnetization fuel—economizer. There are arranged a plural of parallel through cavities along the longitudinal direction in the housing of the economizer. Each end of the through cavities is connected with a common inlet and outlet tube connector of the fuel tube and each through cavity has many pairs of permanent magnet with magnetic circuit sheets arranged as in th embodiment 2. This kind of fuel—economizer is especial for the magnetization of fuel in large internal combusion engine.

To compare with the prior art, the fuel—economizer according to the invention has the following advantages.

1. A closed magnetic circuit has been formed in this fuel—economizer by the application of industrial purity iron or silicon steel sheet which greatly enhance instrumental magnetic field intensity with the magnetic field intensity in the magnetic filter cavity having increased 50% and that in the magnetization cavity having increasing over 10% so as to greatly improve the magnetizion effect for the fuel.

2. The application of intensified two or more stages magnetization process has a superposition effect, which may sufficently develop the magnetization effect of high magnetic energy product and high magnetic field intensity of permanent magnets to the fuel so as to render a further fuel saving and a reduction of the emission of harmful substances. The experiments and practices show that by the invention, an fuel saving rate of 10%~25% may be realized; CO and HC reduces respectively 20%~80% with CO reducing 35% in average and reducing 80% at maximum, HC reducing 30% in average and reducing 80% at maximum; and the smoke density reduces over 20%.

3. The magnetic filter cavity has an instrumental magnetic field intensity up to 6000 gausses which can be used not only to magnetize the fuel for the first stage but also to adsorb iron magnetic particulates in the fuel effectively so as to protect effectively the permanent magnet in the magnetic filter cavity from accumulated with iron magnetic substances.

The embodiments according to the invention have been described with reference to the accompanying drawings. The invention may have various changements and modifications which should be included in the spirit and scope of the invention.

Claims

1. A magnetization fuel—economizer for an internal combustion engine, comprised of a housing (1) having a longitudiual through cavity, and two ends of said through cavity being disposed hermetically on a tube connector (13, 14) communicated with an fuel supply pipe, the tube connector (13, 14) possessing a flared flow passage, a magnetization cavity perpendicular to the through cavity having been disposed two permanent magnets (3, 4) with their magnetic poles opposed each other, and the interval between the two permanent nagnets (3, 4) forming a fuel passing gap with a width of 0.5~2.0mm; and, in addition, a magnetic filter cavity arrange to communicate with the through cavity and to parallel to the magnetization cavity with a permanent magnet (2) in the magnetic filter cavity, wherein the other ends of the opposed magnetic poles of the two permanent magnets (3, 4) in the magnetization cavity are provided respectively with magnetic circuit sheets (7, 8) to form a closed magnetic circuit, and that one end of the permanent magnet (2) in the magnetic filter cavity is provided with a magnetic circuit sheet (6) and the other end of the permanent magnet (2) is opposed to a magnet circuit sheet (5) disposed on the bottom surface of the magnetic filter cavity, thus to form a fixed fuel passing gap between the permanent magnet (2) and the magnetic circuit sheet (5).

2. The magnetization fuel—economizer according to claim 1, wherein the two permanent magnets (3, 4)

disposed in the magnetization cavity may have their magnetic pole opposed each other with the N pole to N pole, or S pole to S pole, or N pole to S pole, and said magnetic circuit sheets (7, 8) are disposed on the other ends of the opposed magnetic poles.

3. The magnetization fuel—economizer according to claim 1, wherein a fuel passing gap between the permanent magnet (2) in the magnetic filter cavity and the magnetic circuit sheet (5) in the bottom surface of magnetic filter cavity is of a width from 1mm to 5mm.

4. The magnetization fuel—economizer according to claim 1, wherein the magnetic circuit sheets (5, 6, 7, 8), are of shapes in circular disk or in cylinder with diameters from 6mm to 80mm, and thickness from 0.3mm to 10mm.

5. The magnetization fuel—economizer according to claim 1, wherein the magnetic circuit sheets can be made from the magnetic conductance material such as industrical purity iron DT 4 or silicon steel sheet.

6. The magnetization fuel—conomizer according to claim 1, wherein the permanent magnets (2, 3, 4) are made from the material NF30H with an inherent coercive force in the range of 18000—20000 oersteds and a pole face magnetic field intensity in the range of 4000—5200 gausses.

7. The magnetization fuel—economizer according to claims 1—6, wherein the fuel—economizer is a multi—cavity fuel—economizer with many pairs of permanent magnets (3, 4).

8. The magnetization fuel—economizer according to claims 1—6, wherein the fuel—economizer is a multi—fuel circuit economizer with a plural of through cavities.

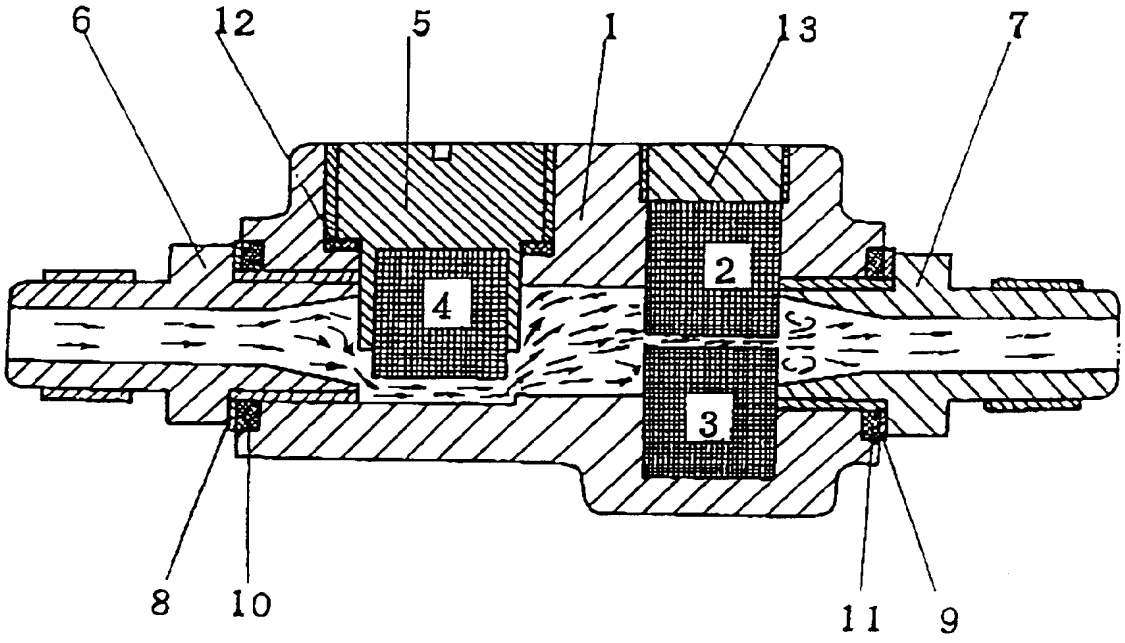

FIG. 1

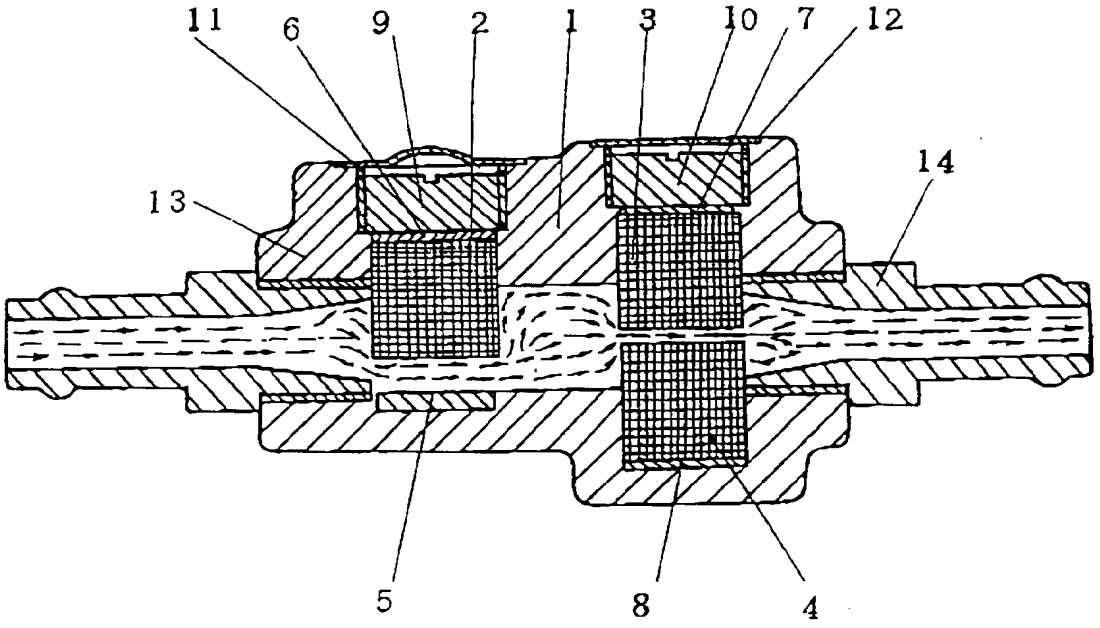

FIG. 2

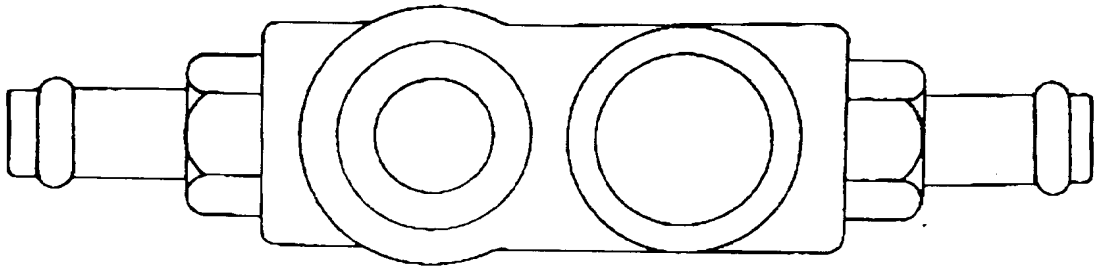

FIG. 3

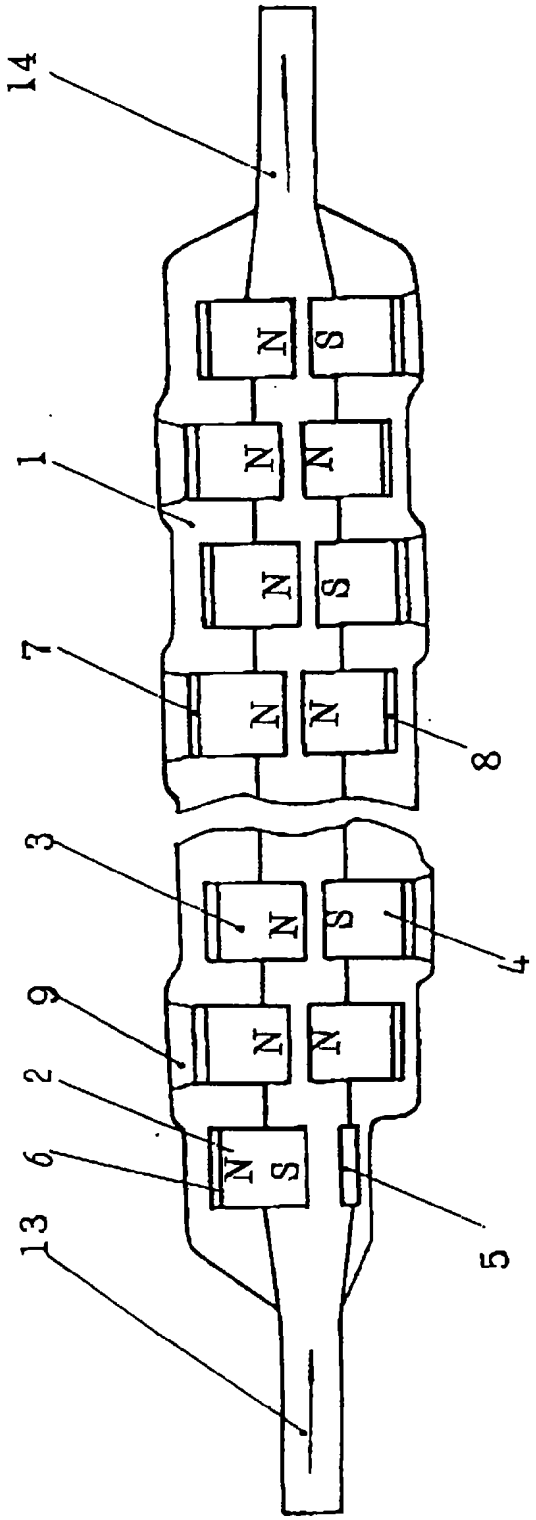

FIG. 4

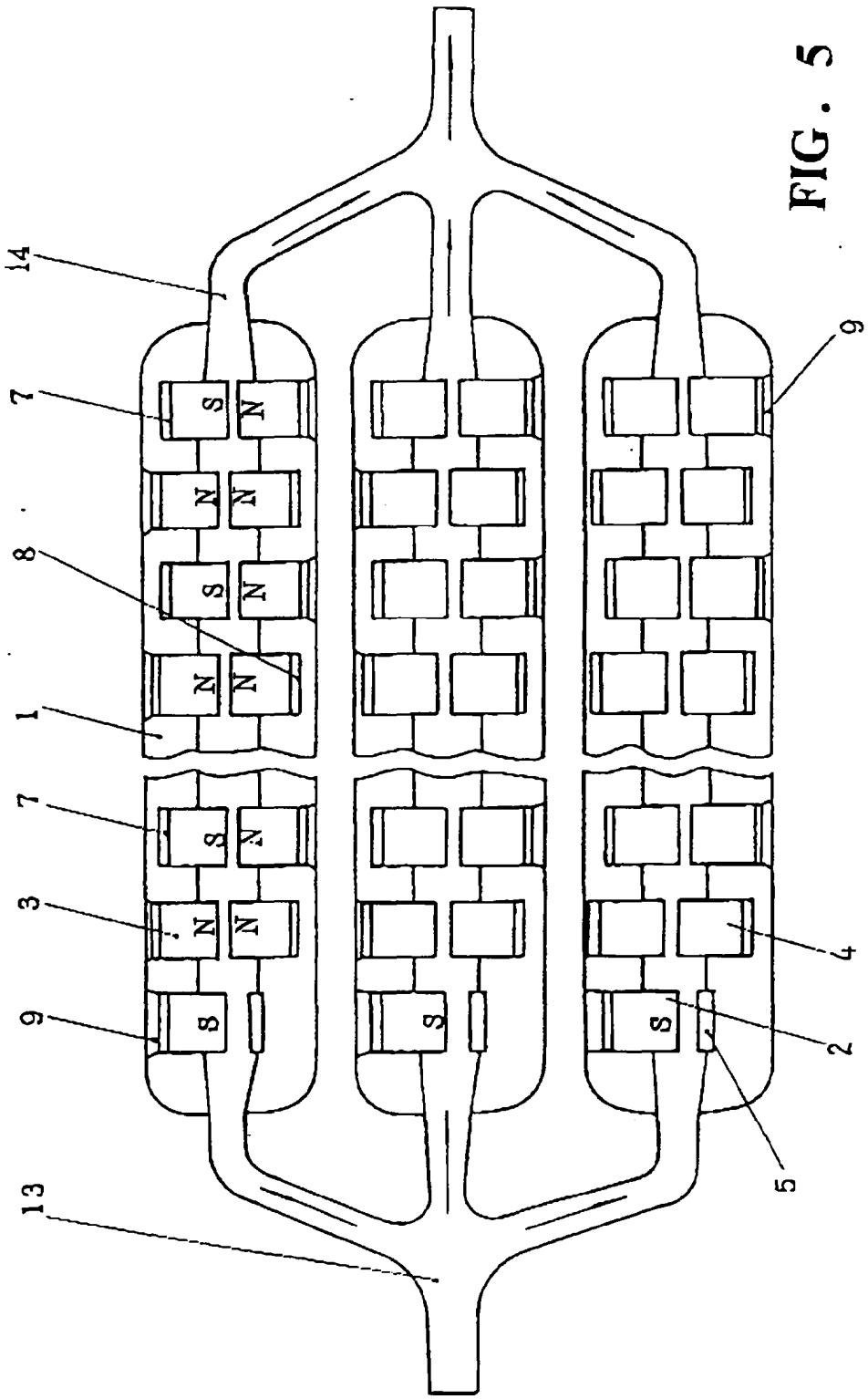

FIG. 5

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN 95/00082

A. CLASSIFICATION OF SUBJECT MATTER

IPC[6] F02M 27/04

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC[6] F02M

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Chinese invention 1985~1995, Chinese utility models 1985~1995

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

WPI, CPRS, CIPIS, CNPAT; Internal combustion engine, fuel, magnetic magnet.

C. DOCUMENTENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	CN—2, 120, 189(Beijing Yuantong Co.)(28.10.92) See the whole documents.	1,2,3,5,6,7,8
Y	CN—2, 157, 990(Xiao Dawen)(02.03.94) See the whole documents.	1,2,3,5,6,7,8
Y	US—5, 124, 045(Janczak et. al)(23.06.92) See the whole documents.	1,3,5,6
Y	US—5, 063, 368(Ettehadieh)(05.11.91) See the whole documents.	1
Y	CN—2, 049, 269(Wang Yunmin)(13.12.89) See the whole documents.	1,7

☒ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier document but published on or after the international filing date
"L" document which may throw doubts on priority claims(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
15. Dec. 1995(15.12.95)	21 DEC 1995 (21.12.95)
Name and mailing address of the ISA/ Chinese Patent Office, 6 Xitucheng Rd. Jimen Bridge, Haidian District, 100088 Beijing, China Facsimile No. (86—1)2019451	Authorized officer JIANG Qing Telephone No. (86—10)2093720

Form PCT/ISA/210(second sheet)(July 1992)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN 95/00082

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	CN—2,103,654(Li Xiaoguang)(06. 05. 92) See fig 1	1,7
A	CN—2, 170, 380(Lin Qubaoer)(29. 06. 94) See fig 1	1,2
A	CN—2, 140, 967(Beijing Chaoyang Qu Jingma Magnetic Elements Factory)(25. 08. 93) See fig 1,2	1,4

Form PCT/ISA/210(continuation of second sheet)(July 1992)